AMENDMENT TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

LISTING OF CLAIMS

1 – 120 (cancelled)

121. (new) A method for interpolating a vector-valued function, the vector-valued function relating a plurality of at least two-dimensional positions to a plurality of respective displacement vectors, the method comprising:

providing an array of grid elements, each grid element having a coordinate region, and each grid element containing at least a displacement vector magnitude and a displacement vector direction;

providing a real-valued input position vector having real-valued coordinates, the coordinates falling within the coordinate region of a grid element;

rounding the coordinates of the real-valued input position vector so as to provide an integer grid position vector;

subtracting the integer grid position vector from the real-valued input position vector to provide a sub-grid position vector;

using the integer grid position vector to access the contents of a grid element, the contents of the grid element including a displacement vector magnitude, and a displacement vector direction;

using the displacement vector direction to provide a unit vector in the displacement vector direction;

using the unit vector in the displacement vector direction and the sub-grid position vector to provide a component of the sub-grid position vector in the displacement vector direction;

subtracting the displacement vector magnitude from the component of the sub-grid position vector in the displacement vector direction to provide an interpolated displacement vector magnitude; and

combining the interpolated displacement vector magnitude, the unit vector in the displacement direction, and the displacement vector direction so as to provide an interpolated displacement vector corresponding to the real-valued input position vector.

122. (new) The method of claim 121, further comprising:

using the integer grid position vector to provide the contents of a grid element, the contents of the grid element including grid element information.

123. (new) The method of claim 122, wherein the integer grid position vector is used to provide a memory address, the memory address being used to access the contents of the grid element indexed by the memory address.

124. (new) The method of claim 121, wherein using the integer grid position vector to access the contents of a grid element includes:

using the integer grid position vector to provide a memory address; and

using the memory address to access the contents of a grid element indexed by the memory address.

125. (new) The method of claim 121, wherein using the displacement vector direction to provide a unit vector in the displacement direction is performed using a cosine/sine method.

126. (new) The method of claim 121, wherein using the displacement vector direction to provide a unit vector in the displacement direction is performed using a look-up table.

127. (new) The method of claim 121, wherein using the unit vector in the displacement direction and the sub-grid position vector to provide a component of the sub-grid position vector in the displacement direction is performed using a dot product.

128. (new) The method of claim 121, wherein the real-valued input position is provided in grid coordinates.

129. (new) The method of claim 121, further comprising:

using a neighboring grid element.

130. (new) A method for interpolating a vector-valued function, the vector-valued function relating a plurality of at least two-dimensional positions to a plurality of respective displacement vectors, the method comprising:

providing an array of grid elements, each grid element having a coordinate region, and containing at least a displacement vector magnitude and a displacement vector direction;

providing a real-valued input position vector having real-valued coordinates, the coordinates falling within the coordinate region of a grid element;

using a unit vector in the displacement vector direction to provide an interpolated displacement vector magnitude; and

combining the interpolated displacement vector magnitude, the unit vector in the displacement direction, and the displacement vector direction so as to provide an interpolated displacement vector corresponding to the real-valued input position vector.

131. (new) The method of claim 130, wherein using a unit vector in the displacement vector direction to provide an interpolated displacement vector magnitude includes:

using the displacement vector direction to provide a unit vector in the displacement vector direction.

132. (new) The method of claim 130, wherein using a unit vector in the displacement vector direction to provide an interpolated displacement vector magnitude includes:

using the unit vector in the displacement vector direction and the displacement vector magnitude to provide an interpolated displacement vector magnitude.

133. (new) The method of claim 130, wherein the real-valued input position vector is used to access the contents of a grid element, the contents of the grid element including a displacement vector magnitude, and a displacement vector direction.

134. (new) The method of claim 133, wherein the real-valued input position vector is used to access the contents of a grid element by converting the real-valued input position vector into an integer grid position vector.

135. (new) The method of claim 134, wherein the integer grid position vector is used to provide a memory address, the memory address being used to access the contents of the grid element indexed by the memory address.

136. (new) The method of claim 130, wherein using a unit vector in the displacement vector direction includes:

performing a dot product using the unit vector.

137. (new) The method of claim 136, wherein performing a dot product using the unit vector provides a component in the displacement vector direction of the vector derived by subtracting the integer grid position vector from the real-valued input position vector.

138. (new) The method of claim 130, wherein using a unit vector in the displacement vector direction includes:

performing a dot product using the unit vector and a vector derived from the real-valued input position vector.

139. (new) The method of claim 138, wherein the vector derived from the real-valued input position vector is obtained by subtracting the integer grid position vector from the real-valued input position vector.

140. (new) The method of claim 137, wherein subtracting the displacement vector magnitude, from the component in the displacement vector direction, of the vector derived by subtracting the integer grid position vector from the real-valued input position vector, provides the interpolated displacement vector corresponding to the real-valued input position vector.

141. (new) An apparatus for interpolating a vector-valued function, the vector-valued function relating a plurality of at least two-dimensional positions to a plurality of respective displacement vectors, the apparatus comprising:

a grid element source adapted to provide an array of grid elements, each grid element having a coordinate region, and each grid element containing at least a displacement vector magnitude and a displacement vector direction;

a position source adapted to provide a real-valued input position vector having real-valued coordinates, the coordinates falling within the coordinate region of a grid element;

an integer rounding module, cooperative with the position source, and adapted to round the coordinates of the real-valued input position vector so as to provide an integer grid position vector;

a first subtraction module, cooperative with the integer rounding module, and adapted to subtract the integer grid position vector from the real-valued input position vector to provide a sub-grid position vector;

an address generation module, cooperative with the integer rounding module and the grid element source, and adapted to use the integer grid position vector to access the contents of a grid element, the contents of the grid element including a displacement vector magnitude, and a displacement vector direction;

a unit vector module, cooperative with the grid element source, and adapted to use the displacement vector direction to provide a unit vector in the displacement vector direction;

a component extractor, cooperative with the unit vector module, and adapted to use the unit vector in the displacement vector direction and the sub-grid position vector to provide a component of the sub-grid position vector in the displacement vector direction;

a second subtraction module, cooperative with the component extractor, and adapted to subtract the displacement vector magnitude from the component of the sub-grid position vector in the displacement vector direction to provide an interpolated displacement vector magnitude; and

an output module, cooperative with the second subtraction module, and adapted to combine the interpolated displacement vector magnitude, the unit vector in the displacement direction, and the displacement vector direction so as to provide an interpolated displacement vector corresponding to the real-valued input position vector.

142. (new) The apparatus of claim 141, further comprising:

an address generation module, cooperative with the integer rounding module and the grid element source, and adapted to use the integer grid position vector to provide a memory address to the grid element source, the memory address being used to access the contents of the grid element indexed by the memory address.

143. (new) The apparatus of claim 141, wherein the unit vector module includes a look-up table.

144. (new) The apparatus of claim 141, wherein the grid element source includes a memory array.

145. (new) An apparatus method for interpolating a vector-valued function, the vector-valued function relating a plurality of at least two-dimensional positions to a plurality of respective displacement vectors, the apparatus comprising:

a grid element source adapted to provide an array of grid elements, each grid element having a coordinate region, and containing at least a displacement vector magnitude and a displacement vector direction;

a position source, cooperative with the grid element source, and adapted
to provide a real-valued input position vector having real-valued
coordinates, the coordinates falling within the coordinate region of a grid
element;

a unit vector module, cooperative with the grid element source, and
adapted to use the displacement vector direction to provide a unit vector
in the displacement vector direction for use in computing an interpolated
displacement vector magnitude; and

an output module, cooperative with the unit vector module, and adapted
to combine the interpolated displacement vector magnitude, the unit
vector in the displacement direction, and the displacement vector
direction so as to provide an interpolated displacement vector
corresponding to the real-valued input position vector.

146. (new) The apparatus of claim 145, further comprising:

a sub-grid position module, cooperative with the position source, and
adapted to use the real-valued input position vector to provide a sub-grid
position vector.

147. (new) The apparatus of claim 146, further comprising:

a component extractor, cooperative with the unit vector module, and
adapted to use the unit vector in the displacement vector direction and
the sub-grid position vector to provide a component of the sub-grid
position vector in the displacement vector direction.

148. (new) The apparatus of claim 147, further comprising:

a force magnitude modifier, cooperative with the component extractor
and the grid element source, and adapted to modify the force magnitude
in accordance with the component of the sub-grid position vector in the
displacement vector direction to provide the interpolated displacement
vector magnitude.

149. (new) The apparatus of claim 145, further comprising:

a memory addresser, cooperative with the position source and the grid
element source, for converting the real-valued input position vector into
a memory address, the memory address being for accessing the contents
of a grid element.

150. (new) The apparatus of claim 145, wherein the unit vector module includes
a look-up table.

151. (new) The apparatus of claim 145, wherein the unit vector module includes
cosine/sine module.